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Mortgage Insurance as a Macroprudential Tool: Dealing with the Risk of a Housing Market Crash in Canada

More than one-half of outstanding mortgage debt in Canada is now covered by federally backstopped insurance. Reforms are needed to better align the structure, pricing and oversight of the government-supported mortgage insurance backstop to mitigate the likelihood of, and damage from, housing crises.

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The Study In Brief

In an era of rising house prices and high mortgage debt, heightened concern over the potential exposure of Canada's mortgage insurance system – and taxpayers – is merited. While Canada has not experienced a US-style housing bust, house-price declines ranging from 30 percent to 50 percent have occurred in many other OECD countries since 1970. When accompanied by rising unemployment or preceded by lax underwriting standards, housing busts have resulted in loan losses that threatened the solvency of the financial system. Since large busts have occurred across countries with different housing-finance structures, it is vital that Canada's housing-finance system is able to withstand such a crisis.

The federal government currently backstops mortgages insured by the Canada Mortgage and Housing Corporation (CMHC) as well by private mortgage insurers, meaning taxpayers are ultimately on the hook for a share of losses. Our analysis indicates that a low-probability severe housing crash could result in roughly $17 billion of losses for mortgage insurers. Although mortgage insurers' reserves currently exceed the minimum required, these losses would leave the federal government with a bill of up to $9 billion to recapitalize mortgage insurers.

Canadian mortgage insurance already partially incorporates key features that are needed for a solid macroprudential mortgage insurance system. Underwriting standards are prudent and well enforced, especially after recent reforms. In addition, the federal government guarantees – for a fee – all mortgage insurers. However, while the architecture is sound, there is still scope for strengthening. Our recommendations focus on better aligning the structure, pricing and oversight of the government-supported mortgage insurance backstop with the objective of mitigating the likelihood and damage from housing crises.

Our recommendations:

- Redesign the government backstop to focus on events that include a severe housing crash along with rising unemployment. The backstop should be organized as a standalone fund that accumulates reserves in advance of a housing crisis up to a target level and has the capacity to borrow against future revenue if needed.
- The Financial Institutions Supervisory Committee (FISC) should oversee the backstop fund, particularly its pricing policy, accumulation of reserves and target level for reserves.
- Mortgage insurance backstop should be available only for the residential ownership market.

These reforms would better position the Canadian mortgage insurance system to address the risk of a severe housing crash.

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In light of the recent US housing boom and bust, it is not surprising that high and rising Canadian house prices and household debt have raised the spectre of a domestic housing crash.

This fear has put a spotlight on the role of mortgage insurance, particularly current regulations that require federally regulated financial intermediaries to obtain government-backed insurance for high loan-to-value (80 percent or higher) mortgages. As a result, more than one-half of outstanding mortgage debt is now covered by federally backstopped insurance (Poschmann 2011).

The potential risk to taxpayers, according to our estimates, is up to $9 billion. This, combined with other hazards created by publicly guaranteed debt, have led to calls for reform, ranging from a scaling back of the government role to ending all government support of mortgage insurance so that a larger share of housing finance risks would be borne by borrowers and lenders (IMF 2014, Mohindra 2010).

Heightened concern over the current mortgage insurance system in an era of rising house prices and high mortgage debt is merited. While Canada has not experienced a US-style housing bust, house-price declines ranging from 30 percent to 50 percent have occurred in many other OECD countries since 1970. When accompanied by rising unemployment or preceded by lax underwriting standards, housing busts have resulted in loan losses that threatened the solvency of the financial system. Since large busts have occurred across countries with different housing-finance structures, it is vital that Canada's housing-finance system is able to withstand such a crisis.

This leads us to examine the Canadian mortgage insurance system from a macroprudential perspective.[1] Our evaluation is premised on the idea that mortgage insurance should have two objectives: (i) an *ex-ante* policy of lowering the probability of a housing crash and (ii) an *ex-post* objective of mitigating the economic damage should a housing crash occur.

We begin by evaluating how the mortgage insurance system would weather a "tail event" such as occurred in the United States when a crash in housing prices coincided with a prolonged period of high unemployment. Given that mortgage defaults (and losses) are mainly driven by a "double trigger" of so-called underwater mortgages, when the house has a market value below its mortgage, and borrowers are unable to pay (often due to unemployment), this scenario is likely to produce serious consequences for homeowners with mortgages and the overall economy. Since such an extreme situation has not (yet) occurred in Canada,

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1 Macroprudential regulation aims to lower the likelihood of financial crises that produce major recessions, whereas a microprudential approach focuses on the risk of failure of individual institutions (Borio 2003).

we rely on the recent experience of countries such as the United States and Ireland to develop our "top-down" stress test.

Our analysis indicates that a low-probability severe housing crash could result in roughly $17 billion of losses for mortgage insurers (about 1 percent of GDP). Although mortgage insurers' reserves currently exceed the minimum required, these losses would leave the federal government with a bill of up to $9 billion to recapitalize mortgage insurers.

Such a crisis would also trigger the 10 percent deductible on the government guarantee of the mortgage insurance policies issued by insolvent private insurers. The issue is that the deductible kicks in if the insurer is unable to meet its payments – in which case the deductible results in a loss for whoever owns the underlying mortgage. Anticipation of deductible losses could also trigger a "run," where lenders avoid dealing with private insurers, which could result in restricted access to finance for homebuyers, further destabilizing the housing market.

In assessing how to improve the current mortgage insurance system, we focus on three key macroprudential elements. First, all insured mortgages should meet well-designed minimum underwriting standards so as to limit the moral hazard that arises if lenders do not face losses from mortgage default. Recent interventions tightening mortgage insurance underwriting standards leave little need for reform in this area.

Second, unlike the current system, the government backstop should target only the tail-event risk of a systemic housing crash. This could be implemented by conditioning backstop payouts on a minimum decline (say, 25 percent over three years) in a national house-price index.

To increase transparency about taxpayer exposure and guard against large demands on government budgets during a crisis, we recommend a transition to a funded model where reserves are gradually accumulated to guard against future losses. Finally, to protect taxpayers, baseline premiums should cover the expected payouts from the fund. Our rough calculations indicate the current premiums that the federal government charges insurers are too low and may need to be increased.

Our rationale for a continued but more focused government backstop is based on financial stability. Losses from a systemic housing crisis, where a sustained period of high unemployment coincides with a large fall in house prices and rising mortgage defaults, can threaten the solvency of even well-capitalized insurers. Uncertainty about the future solvency of insurers can see lenders tighten lending standards to avoid exposures to possible future mortgage defaults. This can lead to house-price declines and to larger losses from mortgage defaults. By reducing uncertainty about losses, a government backstop can help stabilize housing finance during a systemic crisis.

The third and final element of an ideal macroprudential mortgage insurance system is dynamic pricing targeted at dampening housing market fluctuations. Mortgage insurance premiums should rise (fall) during periods of rapidly rising (falling) house prices. This lean-against-the-wind pricing moves a potential housing crash to higher-risk periods while working to smooth house-price fluctuations.

To operationalize macroprudential insurance pricing, a markup could be added to the baseline premium for the backstop charged to insurers. Responsibility for setting this markup, as well as for operating the backstop fund, should be delegated to the Financial Institutions Supervisory Committee (FISC), a group of senior officials from the Department of Finance, Office of the Superintendent of Financial Institutions, Canadian Deposit Insurance Corporation, Financial Consumer Agency of Canada and the Bank of Canada that advises the federal government on financial system issues. FISC should conduct an

annual stress test of Canadian housing finance, which could help inform the public on emerging risk factors.

One question we leave unanswered is the future role of the Canada Mortgage and Housing Corporation (CMHC). While our recommended mortgage insurance architecture could work with or without the CMHC, the current model that sees the CMHC compete with private insurers may help stabilize housing finance should a crisis occur, albeit at the cost of reduced competition. As a result, any future consideration of privatizing the CMHC's mortgage insurance business should take into account the potential trade-off between market efficiency and macroprudential stability.

1. Mortgage Insurance in Canada: The Current Regime

Compared to other countries, Canadian housing finance relies heavily on mortgage insurance (BIS 2013, Blood 2009). This reflects legislation prohibiting federally regulated financial intermediaries from making high loan-to-value mortgages (currently defined as mortgages with less than a 20 percent down payment) without mortgage insurance. Although premiums are paid by borrowers (typically by adding them to mortgage payments), mortgage insurance is a risk-transfer product that shifts potential mortgage default losses from lenders to insurers.[2] The typical policy sees insurers guarantee the outstanding balance for the entire amortization period and is portable should the borrower refinance with a different lender.

The two main private insurers, Genworth Canada and Canada Guaranty, compete with the CMHC, a Crown corporation. Currently, the CMHC accounts for roughly 60 percent of mortgage insurance, with Genworth Canada holding roughly one-third. While all three underwrite insurance for residential mortgages for one to four units, only the CMHC insures multi-unit residential rental properties.

Although premiums vary by loan-to-value ratios, they do not vary with risk factors such as occupation, credit score or location. In practice, private insurers generally match the CMHC premium schedule. The lack of price dispersion may reflect borrowers having little incentive to distinguish among insurance products, combined with the limited incentive by lenders to bargain for lower premiums. Competition thus takes place mainly on the product and process level, where private insurers are somewhat more flexible in targeting specific demographic and socioeconomic groups with a focus on insuring mortgages in urban centres.

In addition to traditional insurance for high loan-to-value (LTV) residential loans, insurers may offer bulk or portfolio insurance for bundles of mortgage loans with an LTV below 80 percent. The motive for purchasing bulk insurance varies among mortgage lenders. One rationale is to reduce capital costs, since insured mortgages have a lower-risk weight for capital requirements.

A more important reason is securitization, as only insured mortgages are eligible for inclusion in *National Housing Act* Mortgage-Backed Securities (NHA MBS) or Canada Mortgage Bond (CMB) securities. Operated by the CMHC, the NHA MBS program has doubled since the 2008-09 financial crisis to an annual issuance of about $140 billion, swelling total outstanding MBS to

2 Insurance against house-price declines for homeowners is limited, although economists such as Robert Shiller have argued that they would be socially valuable.

roughly $370 billion.[3] In comparison, the value of outstanding private label MBS peaked at roughly $24 billion in 2008 (Canada Housing Observer 2012).

Insurance Portfolios

The increase in mortgage debt since the financial crisis (see Figure 1) has produced significant growth in the value of insured mortgages. CMHC roughly doubled its insurance-in-force since the onset of the financial crisis to about $546 billion in 2014. Despite declining slightly from its 2013 level, this leaves the CMHC near its legal limit of $600 billion for outstanding principal guarantees.

The government also restricts the total volume of CMHC-backed mortgage securitization.[4] Meanwhile, Genworth together with Canada Guaranty are not yet constrained by the $300 billion limit for private insurers for outstanding insurance-in-force.

This implies that between one-half and two-thirds of the $1.2 trillion in outstanding mortgage loans are insured. The increased reliance on mortgage insurance since 2007 is driven by several factors. First, since the 2008 crisis, some lenders have faced more difficult access to private funding sources, making CMHC-backed MBS more attractive. Second, a new banking regulation (the Basel III framework) has strengthened incentives for banks to hold insured mortgages. Insurance reduces regulatory capital charges and NHA MBS count toward required holdings of liquid assets. Finally, the crisis may have heightened lenders sensitivity to potential risks, making mortgage insurance relatively more attractive (especially since premiums have remained stable over the last decade). Combined with the rise in household debt, this has resulted in the value of insured mortgages roughly doubling since the financial crisis.

The federal government is an active participant in mortgage insurance, as it regulates underwriting standards and guarantees promised payments to lenders. In addition, the CMHC has a financial stability mandate, partly due to its key role in mortgage securitization. Oversight of the CMHC's commercial activities has recently intensified, with the Office of the Superintendent of Financial Institutions (OSFI) taking responsibility for this function in 2012.

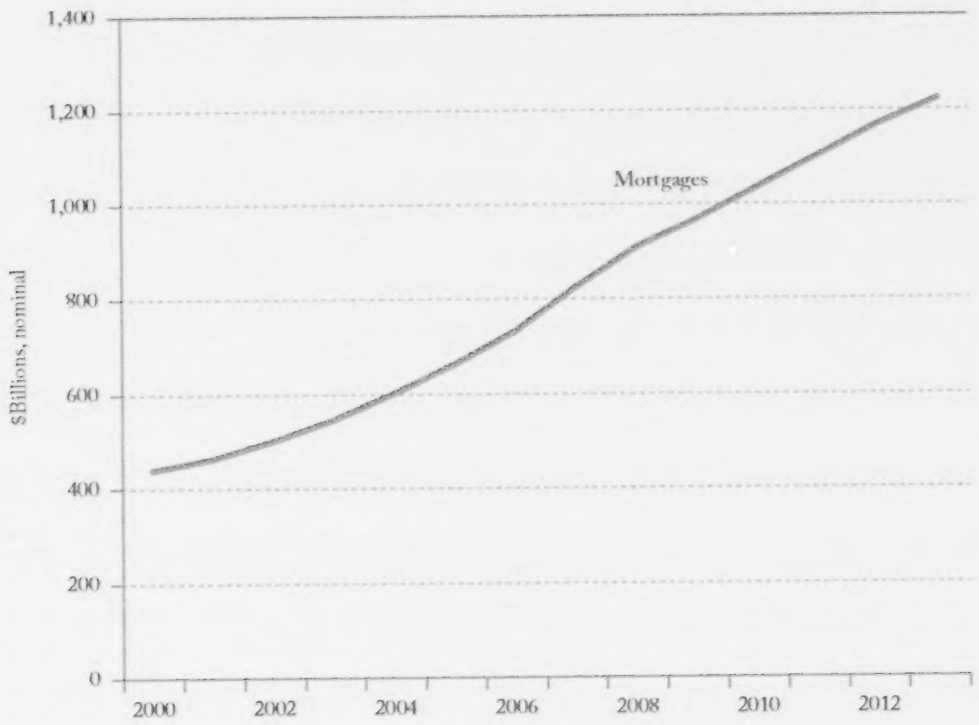
Ottawa specifies minimum underwriting standards for insured mortgages, including the minimum down payment (currently at least 5 percent), the maximum gross and total debt-service ratios (now 39 and 44 percent, respectively),[5] amortization period (no more than 25 years), a minimum credit score as well as a (now explicit) $1 million cap on the cost of the home. These standards have varied over the years, with a

3 The CMHC's securitization role mimics that of the US Ginnie Mae, with the CMHC guaranteeing timely payment for investors. The Canada Mortgage Bonds (CMB) program has the Canada Housing Trust purchase insured NHA MBS using the proceeds from CMB and guarantees CMB holders against the prepayment risk associated with the underlying mortgage.

4 This limit is specified in Section 51 of the *National Housing Act*. In addition, the federal government sets annual limits on new CMHC securitization. For 2014, CMHC could provide up to $80 billion in new guarantees for NHA MBS and up to $40 billion for CMB; the same limits apply in 2015.

5 The maximum gross debt-service ratio is the share of household income spent on monthly housing costs including the mortgage, property taxes and utilities, while the total debt-service ratio adds monthly obligations associated with any debts such as credit cards or auto loans.

Figure 1: Residential Mortgages in Canada ($billions, nominal)



Source: xx

loosening prior to the US crisis being undone by several subsequent tightenings.[6]

Mortgage insurers must also meet underwriting standards outlined in the recent OSFI regulatory guideline B-21. These new rules revise the underwriting practices for federally regulated mortgage lenders in guideline B-20.[7]

Capital requirements for insurers are 175 percent of the Minimum Capital Test (MCT), which both Genworth and CMHC currently exceed. As of

6 While the initial tightening was a reaction to the US crash, more recent measures seem motivated by rising Canadian housing prices. Krznar and Morsink (2014) summarize the changes since 2008 and their impact on borrowing and house prices. MacGee (2010) and Poschmann (2011) discuss some of the pre-2008 revisions.

7 The guidelines are available at http://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/gl-ld/Pages/b21.aspx and http://www.osfi-bsif.gc.ca/Eng/fi-if/rg-ro/gdn-ort/gl-ld/Pages/b20.aspx.

recent financial statements, CMHC holds $15.9 billion in capital to support its insurance business, plus $5.7 billion of unearned premiums designated to cover future losses on insured mortgages.[8] With a smaller insurance portfolio, Genworth holds $3.27 billion in capital and $1.8 billion in unearned premiums.

All mortgage insurance contracts are backed by a federal government guarantee. As a Crown corporation, CMHC is fully backed by the government, while 90 percent of the insured value of private insurers is guaranteed. Thus, if a private insurer were to default on promised payments to lenders, the government would cover losses exceeding 10 percent of the original loan amount insured. As a result, private insurance firms are a riskier counterparty for mortgage lenders than CMHC.

Both CMHC and private insurers pay backstop premiums, for the federal guaranty, with private insurers paying 2.25 percent of total premiums and CMHC paying 3.25 percent. Presumably, the difference is intended to take into account the difference in coverage (100 percent versus 90 percent) and level the playing field.

How Would the Current System Perform During a Housing Crisis?

We employ two counterfactual exercises to identify potential weaknesses in the current mortgage insurance system. Both hypotheticals focus on a tail-risk event where a large and prolonged fall in housing prices coincides with a sharp rise in unemployment.[9]

Our first exercise consists of a stress test to estimate the potential losses of mortgage insurers and the exposure of taxpayers to an extreme, but plausible, housing crash scenario. Second, we ask whether the current system could effectively stabilize housing finance during such a crisis.

Are Capital Levels Sufficient to Deal with a Housing Crash?

Our stress test focuses on the cumulative losses to the CHMC and Genworth from an extreme, but plausible, scenario where a sustained period of high unemployment coincides with a large fall in house prices and rising mortgage defaults (see Appendix A for details).[10] The economics of such a scenario are straightforward. A homeowner-borrower with positive equity who is unable to make mortgage payments can (generally) sell and pocket the equity (avoiding additional costs with foreclosure). Similarly, a fall in house prices that leaves a borrower with an underwater mortgage typically finds default unappealing since the difference between monthly mortgage payments and the cost of renting a similar house are not enough to outweigh default costs such as moving costs, the hit to a credit score, as well as the increased cost of accessing future loans. Thus, large losses on insured mortgages are likely only when a deep fall in house prices coincides with high unemployment.[11]

8 Total CMHC capital is $17.6 billion. Since the CMHC operates several business lines, we allocate only $15.9 billion to the mortgage insurance business. The CMHC has increased its capital by roughly $2 billion since 2013, and is now well above minimum regulatory capital levels.

9 While such a scenario has not (yet) occurred in Canada, the fact that it has happened in other countries suggests that Canadian housing finance should be designed to weather such an event.

10 We do not include Canada Guaranty due to insufficient data on its insurance portfolio.

11 Recent US empirical evidence shows that the main factor in mortgage default among underwater borrowers is an inability to pay the monthly mortgage and housing costs (Gerardi et al. 2013).

A key challenge in developing this scenario is that large housing crashes rarely occur, and Canada has not (yet) experienced such a scenario. This means that past Canadian data on mortgage defaults may underestimate the potential impact of a severe crash.[12] To deal with this, we follow Reinhart and Rogoff (2009b) and pool the experiences of broadly similar countries.

Our (admittedly approximate) top-down, stress-test scenario assumes a peak-to-trough price decline of 30 percent on residential homes and 50 percent on multi-unit properties over five years (Appendix A). We do not explicitly develop an unemployment path, but instead impute a path for mortgage defaults based on other large housing crash episodes. We combine this with an estimate of the average home-equity share for the mortgages in default to estimate the losses of mortgage insurers.

The results of our stress test are worrisome. Losses from mortgage defaults in this scenario are roughly $17 billion, which is more than 1 percent of Canadian GDP. While insurers' capital and reserves cover a large fraction of those losses, the federal government bill, were it to recapitalize insurers, would be in the range of $3 billion to $9 billion.

Our results differ from recent IMF stress tests that are based on CMHC estimates (IMF 2014). Although our scenario for house prices is similar to the IMF's (2014) adverse scenario, our projections for default rates and losses are more pessimistic. While the range of estimates highlights the real challenges of forecasting losses from tail-risk events, losses from large housing-crash episodes in other countries may be more informative than estimates based on past Canadian data when household debt levels were much lower. However, as we discuss later, the large differences in stress test results highlight the need for increased transparency regarding the details that underpin stress tests.

Would the Current System Help Stabilize House Prices in a Crisis?

An alternative approach to evaluating the current regime is to ask whether it would stabilize home ownership financing during a severe housing crisis; that is, a tail-risk event where a large and prolonged fall in housing prices coincides with a sharp rise in unemployment.

Consider the early stages of such a crisis, when lenders recognize that the solvency of their private mortgage insurers could be threatened by a continued fall in prices. In this situation, the difference between the 90 percent government guarantee of a privately insured mortgage versus 100 percent for CMHC-backed mortgages could induce lenders to run from private insurers. The resulting fall in private underwriting income would threaten the viability of private insurers, leaving the CMHC as the main insurance provider.

This disruption in mortgage insurance could reduce prospective homebuyers' access to credit if lenders responded by tightening credit. In turn, this response would amplify the fall in house prices by restricting housing demand, thus deepening the housing crisis.

A government faced with this situation– as during the 2009 recession – could increase the cap on the value of mortgages that the CMHC will insure.[13] While this is a reasonable approach

12 OSFI and the IMF have stress tests for mortgage insurers. These tests, however, focus more on the appropriate capitalization of mortgage insurers based on past Canadian default experience. While more detailed, these tests may underestimate the tail-risk exposure and the contingent liability of the government.

13 Alternatively, the government could drop the deductible on private insurance. Since this policy could easily be perceived as a bailout for private insurers, it could result in political debate that would make it difficult to implement in a timely manner to avoid disrupting housing finance.

to stabilizing the housing-finance system during a crisis, it would be possible only if the CMHC entered the crisis with a large enough presence to meet the increased demand. Moreover, this policy also entails the government taking on additional exposure to mortgage markets at the same time that it is facing fiscal pressure from a slowing economy – potentially leaving taxpayers with a large bill from a housing crash.

Summary: Limitations of the Current System

We take two key messages from our analysis. First, taxpayers face a significant potential exposure from the current backstop of mortgage insurance. Second, the current system may induce a destabilizing run from private insurers during a housing crash. These observations raise the questions of whether there is any role for government in the mortgage insurance market and, if so, what that role should be. The next section tackles these questions and outlines the macroprudential rationale for government intervention in the mortgage insurance market to lessen the likelihood and economic damage of housing crises.

2. Is there a Role for Macroprudential Policy in the Mortgage Insurance Market?

Economic theory points to two market failures that may result in excessive systemic risk in housing markets. The first is a pecuniary externality, whereby mortgage lenders do not fully internalize how an additional risky mortgage loan may increase losses on other loans should the market decline (Bianchi and Mendoza 2013). The second is that the large losses from housing crashes (Box 1) are difficult for private sector entities to insure against. This reflects a limited ability of private agents to commit to use future revenue streams to repay current losses.

These two market failures leave a private mortgage insurance market vulnerable to systemic shocks. While introducing a government-backed reinsurance fund can help mitigate the impact of a crisis, dealing with the incentive for excessive risky lending during housing booms requires a levy imposed by a macroprudential regulator.

Our argument for government intervention does not rely on the commonly cited rationale of making housing more affordable for new homebuyers. Although more affordable housing may have been an important political factor in the historical development of mortgage insurance, we do not see a strong economic rationale for taxpayers to subsidize higher-risk borrowers.[14]

Private Mortgage Insurance Markets and the Tail-Risk Problem

One suggested direction for reform is to move to a fully private mortgage insurance model similar to that of Australia (Mohindra 2010). A fully private model sees competitive for-profit mortgage insurers set premiums to cover operating costs plus the expected loss from mortgage defaults. Government involvement is limited to setting prudential underwriting standards and minimum capital requirements.[15]

Compared to other common insurance lines (e.g., auto, life), mortgage insurance claims vary

14 There are other policy tools better suited to deal with access to housing. For example, direct subsidies to lower-income households, streamlined approval processes for new developments or subsidies for social housing projects could be used to subsidize homebuyers with limited savings for down payments.

15 This includes restricting mortgage insurance to monoline insurers so as to isolate the aggregate risk of cyclical swings in mortgage defaults from other insurance lines.

Box1: House-Price Booms and Busts

The recent US crisis is front and centre in many Canadians' worries about the risk of a housing market boom and bust. The American experience is not exceptional, as similar episodes have occurred in other countries. As documented in Table 1, real (i.e., adjusted for inflation) house-price booms and busts of at least 15 percent have occurred in 17 of 18 OECD countries, including Canada, since the 1970s. Australia is the only country that has yet to experience a housing bust.

The academic work on housing busts offers three important lessons. First, house-price crashes have occurred in many countries, across a variety of housing-finance systems and time periods. This suggests that Canada is not immune from the risk of a housing crash. Second, housing crashes that coincide with systemic banking crises often are part of deeper and more prolonged recessions. This highlights the importance of preventing a housing crash from triggering a full-fledged banking crisis. Finally, the deep recessions associated with housing busts often stress government finances.

Historical experience suggests that simple metrics – such as house booms and increases in rent-income ratios – are not sufficient to predict subsequent large house-price declines. Andre (2010) reports that one-third of the large price increases in OCED countries since 1970 were not followed by sharp declines.[a] In addition, not all episodes of large price declines resulted in high rates of foreclosure or loan losses. As a result, while fundamental measures such as rent-to-price or income-to-price ratios may signal increased risk, they do not guarantee a future house-price decline.

Large house-price declines often coincide with deeper and longer recessions. Abmann, Boysen-Hogrefe and Jannsen (2011) examine a broad measure of house-price declines, where prices fell by 7.5 percent or more, in 15 industrialized countries. They find that large house-price declines are associated with GDP declines of 2 percent in the initial year and 1.5 percent in the second year.

Meanwhile, Reinhart and Rogoff (2009) document 11 cases of house-price declines of more than 20 percent that coincided with systemic banking crises since 1977 (more recent episodes in Ireland and Spain bring this to at least 13). House-price crashes that coincide with banking crashes are protracted and result in large price declines. The average of their sample, which excludes the 2008 crisis, is a peak-to-trough decline in house prices of more than 35 percent, with a mean duration of six years. While these numbers are close to the recent US housing bust, even larger house-price crashes occurred in the early 1990s in Finland (50 percent) and Japan (nearly 40 percent).

a Bordo and Landon-Lane (2013) find house-price booms associated with loose monetary policy are more likely to be followed by significant price declines. However, how to identify precisely which housing booms are likely to end in busts is an ongoing research question (e.g., see Burnside et al 2011).

Table 1: Large House-Price Declines in OECD Countries Since 1970

Country	Period	Real Decline (percent)	Nominal Change (percent)
Canada	1981Q1-1985Q1	-20.9	6.6
United States	2006Q2-2012Q1	-42.7	-35.1
Denmark	1979Q2-1982Q4	-36.8	-7.0
	1986Q1-1993Q2	-35.6	-18.1
	2007Q1-2009Q2	-30.3	-26.3
Finland	1974Q2-1979Q1	-30.3	21.1
	1989Q1-1993Q2	-49.7	-40.0
France	1981Q1-1984Q3	-18.1	14.9
	1991Q2-1997Q1	-18.0	-8.4
Germany	1981Q2-1987Q3	-15.3	-2.9
	1994Q4-2008Q4	-26.5	-8.7
Italy	1981Q1-1986Q2	-35.3	17.0
	1992Q3-1998Q2	-26.0	-8.9
Ireland	1981Q3-1987Q2	-27.1	13.1
	2007Q3–2013Q1	-50.6	-49.4
Japan	1973Q4-1977Q3	-30.5	7.5
	1991Q1-2009Q3	-47.2	-44.9
Netherlands	1978Q2-1985Q3	-50.4	-32.0
New Zealand	1974Q3-1980Q4	-37.8	47.8
Norway	1986Q4-1993Q1	-40.6	-22.0
Spain	1978Q2-1986Q1	-32.2	75.1
	1991Q4-1996Q3	-17.6	1.7
South Korea	1991Q2-2001Q1	-47.5	-18.6
Sweden	1979Q3-1986Q1	-37.9	11.3
	1990Q1-1996Q2	-28.2	-8.4
Switzerland	1973Q3-1976Q3	-29.0	-15.3
	1989Q4-2000Q1	-40.7	-25.9
United Kingdom	1973Q3-1977Q3	-33.7	30.0
	1989Q3-1995Q4	-27.8	-6.8
	2007Q4-2009Q2	-20.9	-17.2

Source: Most data are from André (2010) who reports real (i.e., adjusted for inflation) house-price booms and busts of at least 15 percent in 18 OECD countries since the 1970s. The nominal change is the real price decline reported. by Andre (2010) scaled by the change in the CPI. The US decline is from the Case-Shiller 20 City index, and the 2007-2013 Irish price declines is for existing single-family homes.

substantially over time. The traditional response is to rely on capital regulation to maintain the solvency of insurers. However, as our stress test illustrates, even insurers that are well capitalized for normal housing cycles may see their solvency threatened during a housing crash. Given the essential role mortgage insurers play in housing finance, this scenario would present the government with a "too-important-to-fail" problem that would leave a taxpayer-funded bailout as the least worst option.

On a practical level, imposing high capital requirements to withstand the losses from a housing crisis is unlikely to happen due to the upfront cost. This is what motivates insurers in other industries with time-varying claims (such as property insurers) to seek re-insurance for part of their exposure. However, re-insurance markets are not well developed for catastrophic risk (Jaffee and Russell 1997).

An alternative approach to handling rare, but large losses is to commit to building reserves steadily over time. With this approach, realized losses can be spread into the future through borrowing if a large loss occurs before enough reserves are accumulated. This debt is then gradually paid off via future premiums.

Government has a comparative advantage over private insurers in implementing this approach since it can require future market participants to pay.[16] In contrast, private insurers that attempt to use future premiums to repay past losses face the risk of new entrants – not burdened by legacy losses – undercutting their prices. Moreover, so long as government fiscal policy is consistent with low default risk, it can borrow at better rates than a private firm.[17]

Government Backstopped Mortgage Insurance

One practical solution to the tail-risk problem is to mandate participation in a government-sponsored backstop fund that charges all mortgage insurers a fee to guarantee their policies. An essential operational issue would be setting appropriate prices for the backstop guarantee. To protect taxpayers, the base fee charged insurers should cover expected payouts. However, the nature of tail-risk events means that there is limited data with which to estimate the likelihood and losses from a housing crash in Canada.

One solution – which we advocate – is to use cross-country data to estimate a reasonable range of fees (see Appendix B). These calculations can be combined with detailed stress tests based on the distribution of insured mortgages across households to develop improved estimates.

A backstop fund can support either a private mortgage insurance system or a hybrid public-private approach such as the current Canadian model. In a hybrid, a public utility (e.g., the CMHC) underwrites mortgage insurance in competition with privately owned insurers. Since the public mortgage insurer benefits from a state guarantee, a backstop fund also helps level the competitive playing field between the public and private insurers.

16 This is one rationale for government-mandated deposit insurance, as early US private deposit insurance schemes failed when banks refused to pay premiums to cover past losses (see English 1993).

17 The comparative advantage of governments to deal with low-probability but extreme events is one reason why they backstop a range of such risks, such as massive natural disasters or a major terrorist act (Moss 2002). The key economic rationale for government to backstop these types of risks stems from its lower borrowing rates due to its ability to execute intertemporal transfers.

A hybrid system may make housing finance more resilient in a crisis.[18] Provided that the public utility is large enough to quickly scale up operations in response to a crisis, it can help stabilize housing finance by taking the place of any private firm that operating in that market.[19] Additionally, a public utility can act as a market maker of last resort by temporarily holding foreclosed properties until the real estate market recovers. Therefore, from a macroprudential perspective, a hybrid system offers clear benefits compared to a fully private model.

Dynamic Pricing of the Backstop Fee as a Macroprudential Tool

While the backstop helps mitigate the damage of a housing crash, it does not directly lower the *ex-ante* probability of a crisis. The key mechanism linking mortgage lending and loan losses is house prices. By changing demand for housing, additional lending impacts house prices and that, in turn, affects the likelihood and expected losses on mortgage defaults. During expansions, rising real estate prices mean that default risk and losses are low. Since lenders face low expected losses from default, offering credit at low rates appears profitable. Moreover, rising house prices can initially disguise weak underwriting standards, since borrowers who are unable to afford their payments can avoid default by selling their home. In contrast, during periods of declining house prices, default risk and losses increase.

Mortgage insurance can exacerbate such pro-cyclical dynamics in housing finance. During a housing boom, the low rates of losses on mortgage default make it attractive for insurers to lower prices to compete for market share. But during a housing crisis, the fall in capital levels due to high payouts and the increased likelihood of insurance claims would either push up the price for mortgage insurance or lead mortgage insurers to curtail their underwriting.[20]

One option to mitigate these pro-cyclical dynamics is to incorporate a macroprudential component into the backstop fee. During housing booms, with their rapid price increases, the backstop fee could rise to make more costly the risk transfer from mortgage originators to insurers. This would force market participants to take into account the increased possibility for a tail-risk event such as housing crisis. The practical question, however, is whether there would be sufficient support for large enough levies to significantly impact (risky) mortgage lending during a housing boom.

Key Features of a Macroprudential Mortgage Insurance System

The analysis of market failures in the housing sector points to three essential features of a well-designed

18 This is a common feature of financial infrastructure. For example, in large-value payment systems a public utility competes with private payment infrastructure. The publicly owned and operated payments system is considered safe to remain operable through crisis periods, thereby effectively backing up the private systems that could then reduce operations in high default-risk periods.

19 During the recent financial crisis, private insurers' activities declined and the CMHC took on a larger role. Its portfolio insurance program facilitated the creation of mortgage-backed securities that were eligible for the Insured Mortgage Purchase Program (IMPP) through which the Government of Canada bought about $69 billion worth of insured MBS. The direct effects of this particular program on mortgage availability are debatable, but prices for mortgage-backed securities certainly stabilized after its introduction.

20 Similar "insurance cycles" have been documented in other insurance lines where large claims happen periodically (Winter 1994).

macroprudential mortgage insurance system:

1. Prudent underwriting standards;
2. Sufficient capital to credibly backstop mortgage insurance claims in a housing crash; and
3. Proper pricing of mortgage insurance that internalizes pecuniary externalities and adverse incentives associated with housing booms.

Prudent underwriting standards limit excessive risk-taking by lenders and insurers alike, and need not be directly tied to mortgage insurance. In fact, mortgage insurance underwriting standards are only one part of the overall regulatory framework with standards also established for the mortgage origination process.[21] However, underwriting guidelines for insured mortgages need to be closely monitored and regularly reviewed when the government guarantees mortgage insurers so as to limit moral hazard as well as taxpayer exposure to risky mortgage lending.

In the event of a housing crash, mortgage insurers need not only be de facto financially sound, but also *perceived* to be so. This can be best achieved by a government guaranteed backstop that reinsures the risk of a housing crisis.

Finally, premiums for mortgage insurance should protect taxpayers by being (at least) high enough to cover the expected payouts. In addition, a macroprudential risk premium should be added to help dampen house-price fluctuations.

3. The Way Forward: Recommendations for Building a Macroprudential framework for Canadian Mortgage Insurance

Canadian mortgage insurance partially incorporates the three key features above that are needed for a solid macroprudential mortgage insurance system. Underwriting standards are prudent and well enforced, especially after recent reforms. In addition, the federal government guarantees – for a fee – all mortgage insurers.

However, while the architecture is sound, there is still scope for strengthening. Our recommendations focus on better aligning the structure, pricing and oversight of the government-supported mortgage insurance backstop with the objective of mitigating the likelihood and damage from housing crises.

Recommendation 1 – Redesign the government backstop to focus on tail-risk events.

i. The backstop should be organized as a standalone fund that accumulates reserves in advance of a housing crisis up to a target level and has the capacity to borrow against future revenue if needed.

ii. Payouts should be conditioned on a systemic housing crash with a specific, predetermined trigger.

iii. Payouts should treat all insurers equally, as far as possible.

A move to an independently funded backstop that accumulates reserves is a partial reversal of recent reforms. We feel this emphasis change is warranted for two reasons. First, housing crises often coincide with severe recessions and stress government finances. A segregated fund with a future stream of dedicated revenue would help ring-fence the guarantee for mortgage insurers from other claims on government fiscal capacity. Second, a standalone fund would make the contingent liabilities of the backstop more transparent. This supports

21 To be effective, these standards also require accurate home-value assessments (particularly for refinancing) and documentation of a borrower's income and down payment. Many of these requirements apply equally to non-insured mortgages and are part of OSFI's Guideline B-20.

appropriate pricing of the backstop, which helps protect taxpayers from subsidizing housing finance.

The possibility that a large housing crash occurs before sufficient reserves have been built up can be handled by allowing the fund to issue bonds secured by future fee premiums.[22] To keep borrowing costs low, these bonds should be guaranteed by the federal government. Once a target level for the fund has been reached, additional fees should be remitted to the government, as a return for insuring tail risk in housing finance.

Our macroprudential approach leads us to recommend a more narrowly designed backstop to deal with a very large (but unlikely) housing market crash. This could be implemented in a transparent manner by having the fund pay out only in the event of a predetermined fall in house prices (for example, a 25 percent nominal national decline over two years). To help reduce uncertainty about possible exposure to losses, the deductible on insurance underwritten by private insurers should be removed. This approach would also level the competitive playing field between the CMHC and private insurers.[23]

Restricting the backstop to systemic events would leave mortgage insurers sufficient capital as the main buffer against normal business-cycle fluctuations. This also implies that policyholders could face losses should a mortgage insurer be unable to meet its claims (i.e., be deemed insolvent) outside of a systemic crisis. In addition to creating added incentives for lenders to carefully examine the quality of mortgage insurers' capital on an ongoing basis, this liability restriction would also limit taxpayers' exposure to losses from mortgage defaults.

A practical question is whether this redesign would have implications for bank capital and liquidity regulations. Our view is that our proposed reforms – combined with continued prudent capital requirements for mortgage insurers – should on net make insured mortgages less risky. As a result, we do not envision any substantive changes to the current risk-weights of insured mortgages. However, this is an issue that will need to be closely monitored and reviewed.

Recommendation 2 – The Financial Institutions Supervisory Committee (FISC) should oversee the backstop fund, particularly its pricing policy, accumulation of reserves and target level for reserves. As well, FISC should:

i. **oversee an annual stress test of the Canadian housing finance system, with public reporting of the detailed methodology and data used;**

ii. **based on the stress test and a general assessment of risk, set baseline premiums so that the expected premiums collected equal the expected losses; and**

iii. **add a countercyclical markup to the baseline backstop premium.**

While this committee currently shares information and advises the federal government on financial system issues, we see it taking on a more active macroprudential role within the housing finance

22 An alternative approach would be to issue catastrophe insurance bonds (or cat bonds) to institutional investors until the fund accumulates a large reserve. These investors would be required to make backstop payments in case of large payouts in exchange for a recurrent fee paid by the backstop. Recent experience, however, calls into question how effective such an arrangement would be as many institutional investors would also be negatively affected by a large housing shock that would compromise their own solvency position.

23 The CMHC would remain fully backed by the government due to its status as a Crown corporation.

sector.[24] A key element would be the development of the annual stress test for mortgage insurers and lenders with clear disclosure of its underlying assumptions and data. Ideally, this exercise would build on household-level data to allow a detailed analysis of how different shocks (for example, a jump in the unemployment rate) would impact default risk. The findings from this exercise would be used to price the backstop fund along macroprudential principles and help inform the public about emerging risks in housing finance. An additional benefit would be to help market participants evaluate whether the underlying assumptions of other stress tests exercises (including our own) are reasonable.

To protect taxpayers, the backstop fund should be self-financing. This requires baseline premiums that cover the expected costs of payouts to insurers should future systemic housing crises occur. In addition, the fee charged each insurer should reflect any differences in the risk of the underlying pool of insured mortgages.

In Appendix B, we provide a rough calculation of the appropriate backstop fee to charge mortgage insurers. Based on our stress test and a 30-year horizon for a systemic event to occur, the current premiums appear to be substantially less than what would be required to recapitalize insurers to 175 percent of MCT. However, the breakeven premiums are sensitive to both the current level of capital and to the recapitalization target. Although our calculations are admittedly rough, they highlight the need for a careful re-examination of the current pricing formula.

Our proposal envisions countercyclical changes in the backstop fee. Increasing (lowering) the premium for backstopping mortgage insurance when house prices are rising (falling) quickly has two appealing features. First, it shifts the backstop cost to episodes when mortgage insurance is profitable. For example, lower backstop fees in times of house market stress could help mortgage insurers rebuild their capital position.

Second, our approach provides a way for policy to "lean against the wind" during periods of rapidly changing house prices. Given that backstop fees are relatively small (we envision an average of roughly 5 percent to 10 percent of premiums written), a shifting levy may need to be large to significantly affect insurance premiums and, ultimately, borrowing costs for homebuyers. This calls for a detailed analysis of how the backstop fees could be designed to most affect mortgage lending.

Once FISC is responsible for the backstop, it will need resources to fulfil its mandate. It could build up its own expertise or rely on members to provide the dedicated staff necessary to conduct the stress test, set the target level and establish the appropriate fees. Finally, FISC would also have to decide on who will manage the backstop fund. These reforms also point to the need for additional research on how best to implement active macroprudential policy to dampen house-price fluctuations.

Recommendation 3 –Mortgage insurance backstop should be available only for the residential ownership market.

The macroprudential argument for a government backstop of the rental property market is weaker than for owner-occupied homes. One factor is size – the relatively smaller value of rental investment means it is less systemically important. More importantly, the valuation of rental units is less sensitive to capital gains, as it largely depends

24 The IMF (2014) also recommends that a single body be assigned to monitor systemic risk.

on the present value of rental payments. Given the lack of a macroprudential rationale, we recommend that the government not backstop the rental market segment.

OTHER CONSIDERATIONS

Our financial stability analysis also offers several perspectives on limiting the mortgage insurance backstopped by the federal government and the future role of the CMHC as a mortgage insurer.

Should the Government Restrict the Total Value of Insured Mortgages?

We caution against capping the total insurance available for recent high LTV loans. Such a cap could have the unintended consequence of shifting borrowers to less regulated lenders and lead to a build-up of high-risk mortgages. From a financial stability perspective, a preferable approach is to manage the market-wide risk of high LTV mortgages through variations in mortgage insurance premiums and underwriting standards that directly target the riskiest segments of mortgage lending.

A separate question that deserves further study is the scope of bulk insurance. The 2013 federal budget restricted the use of bulk insurance to mortgages that are part of the CMHC's securitized mortgage program. This measure was driven by a desire to reduce the fraction of outstanding mortgage loans backstopped by the government.

On the other hand, an argument for maintaining a portfolio insurance program is to encourage competition in the mortgage market by facilitating access to the CMHC securitization window for smaller lenders. This could aid financial stability if the underwriting regulations of federally regulated lenders also included non-bank lenders since mortgage insurance is required for NHA-MBS issuance. Offering bulk insurance in a targeted way to smaller mortgage lenders would leave open the possibility of encouraging large mortgage lenders to seek funding through privately issued mortgage-backed securities or covered bonds.[25]

Is there a Continued Role for the CMHC in Mortgage Insurance?

One question that our analysis does not answer is the future role of the CMHC. On the one hand, the mortgage insurance architecture we outline does not rely on a continued CMHC role in underwriting mortgage insurance. This leaves spinning off the mortgage insurance group as a separate (potentially privatized) entity as a plausible option that could potentially encourage competition.

However, the current system, where the CMHC underwrites a significant share of mortgage insurance, offers two key advantages for financial stability. First, a public insurer would be well positioned to stabilize the housing sector during a crisis by scaling up operations to limit the disruption resulting from the exit of a private insurer. Second, the CMHC as market leader could improve the implementation of countercyclical pricing of insurance. Faced with backstop fees that vary with house-price dynamics, the CMHC

25 A related issue is that NHA-MBS qualify as a High Quality Liquid Asset under the recently introduced Liquidity Coverage Ratio (OSFI Liquidity Adequacy Requirements, http://www.osfi-bsif.gc.ca/eng/fi-if/rg-ro/gdn-ort/gl-ld/Pages/LAR_chpt2.aspx#_Toc359336067). Since bulk insurance provides a way to bundle low LTV mortgages into NHA MBS, restricting bulk insurance may affect the available pool of liquid assets in the Canadian market, with possible negative consequences for market liquidity.

could be encouraged to pass the fee through to mortgage lenders. Given the CMHC's role in setting premiums, this would give private insurers incentives to match CMHC pricing.

Overall, this implies any future review of the CMHC's role in underwriting insurance will need to carefully weigh the quantitative trade-off between efficiency and financial stability.

CONCLUSION

The growth in mortgage debt over the last decade has seen a rise in the exposure of the federal government to potential losses from its guarantee of mortgage insurers. This does not, however, imply that the government necessarily should withdraw from backstopping mortgage insurance. To the contrary, the architecture of Canadian mortgage insurance provides a solid foundation for macroprudential policy. Indeed, some proposals to reform the US housing finance system envision a system that shares many features of the Canadian model.[26]

This leads us to recommend incremental reforms to reposition the Canadian mortgage insurance system to better address the risk of a severe housing crash. Guided by financial stability considerations, our recommendations largely build on recent federal measures to refine how it regulates and backstops mortgage insurance. Overall, our analysis indicates that a well-designed mortgage insurance system is an essential macroprudential tool to minimize the Canadian economy's exposure to large risks resulting from housing market cycles.

26 For example, Hancock and Passmore (2011) also argue for an explicit government guarantee for conforming mortgages, with an upfront fee.

Appendix A – Stress Testing Mortgage Insurers Against Extreme Tail Risk

This appendix outlines our simple methodology to estimate the exposures of the CMHC and Genworth to an extreme house-market crash. The objective is to develop a low probability, but plausible scenario where a severe economic downturn compromises the ability of many Canadian households to meet their mortgage payments. As a result, in this scenario sales by financially stressed owners, foreclosure sales and market expectations produce a large fall in house prices.

Our stress test proceeds in three steps. First, we develop an adverse housing market situation that specifies the decline in residential real estate prices, the percentage of mortgages that default, as well as the average home-equity share among defaulting mortgages before prices decline. We then estimate the losses incurred by mortgage insurers and compare these loses to insurers' capital and reserves. Importantly, we distinguish between high and low loan-to-value (LTV) mortgages as well as multi-unit residential properties that include condos.

Data and Assumptions

Capital, reserves and insurance portfolio characteristics are taken from the latest available quarterly financial reports of the CMHC (3rd quarter 2014) and Genworth (4th quarter 2014). We use our professional judgment, as well as that of others, to construct our scenario for house-price declines, default rates and claims faced by mortgage insurers.[27] Below, we briefly outline and justify our key assumptions.

1. Prices decline by 30 percent on residential units and 50 percent on multi-unit properties.

We look at a price decline from peak to trough in a large housing crash. Historically, large real housing price declines have been of this magnitude over roughly a five-year period. The practical challenge in constructing our scenario is how to map data from previous decades, where inflation was higher, into the current inflation targeting regime that has delivered low and stable inflation. This is key since mortgage insurance contracts are denominated in nominal terms, so it is the nominal rather than real price decline that determines the exposure at default. Given our focus on tail risk, we assume that in a low inflation environment the large real price declines are a reasonable guide to nominal price declines. This is broadly consistent with an alternative scenario based on the argument of some experts that Canadian house-price indices and price-to-rent ratios are 50 percent to 75 percent above long-run trends, with even larger deviations in some urban centres.[28]

While some of these developments may reflect fundamental factors (e.g., lower long-term interest rates or demographic trends), a 30-percent price decline would leave prices closer to their long-run trend.

27 Tail-risk scenarios cannot rely on historical data from a single country since they are low probability events. Stress testing is most useful as a risk assessment and risk management tool when objective probability distributions on default rates and losses are not available.

28 See, for example, http://www.economist.com/blogs/dailychart/2011/11/global-house-prices.

We impose a larger price decline on multi-unit properties, as these are investment projects and face more risk.[29]

2. We consider the following default rates for a mortgage insurer's portfolio:

- **High LTV mortgages** **8 percent**
- **Low LTV mortgages** **2 percent**
- **Multi-unit properties** **10 percent**

These default rates are cumulative over a five-year, peak-to-trough housing crisis. Regular cycles see overall default rates vary between zero percent and 1 percent. Mortgage-in-arrears figures for Canada (a good indicator for the flow of mortgages into default) have peaked at around 0.6 percent to 0.7 percent over the last 25 years and roughly 0.3 per cent to 0.4 percent for the past five years.[30]

While our assumed default rates appear high compared to these values, they are not unreasonable. First, our rate is based on the accumulated stock of default mortgages over a five-year horizon. Second, high LTV mortgages are riskier, but do not make up the entire insurance portfolio, so total defaults over the five-year period are significantly lower than the assumed 8 percent. Third, our numbers are compatible with a mortgage-in-arrears rate that topped out in the range of 1 percent to 1.5 percent and would aggregate to a total stock of defaulted mortgages of about 4 percent over five years, which is about double what we have seen in recent recessions. Finally, the difference between the default rates across the three categories roughly reflects current differences in arrears rates reported by the CMHC.

While extreme, these default rates are compatible with a tail-risk event. Moreover, our scenario is not built on the assumption that households default on mortgage loans because they have negative equity in their homes. Given the Canadian context of recourse mortgage lending, our premise is that a severe recession with a large spike in unemployment would drive households into default because they cannot afford their mortgage payments. Recent corrections in housing markets in other countries point to an even higher number of defaults and foreclosures.

Foreclosure filings during the US housing crisis peaked above four times their pre-crisis level.[31] This is arguably a lower bound, since some delinquent mortgages did not end up in default due to restructuring and government assistance. Similarly, Spain has experienced a steady rise in the share of delinquent mortgages, which now exceed 5 percent, and Ireland's total mortgages in arrears currently stand at 16 percent.[32] Hence, while our assumed cumulative defaults over the crisis period are high, they are below those recently observed in other countries.

29 CMHC (2013), "Canadian Housing Observer," Table A-10.

30 These ratios apply to all mortgages outstanding; default rates for insured mortgages are higher, given the smaller denominator in the latter ratio. See http://www.cba.ca/contents/files/statistics/stat_mortgage_db050_en.pdf and CMHC (2013), Canadian Housing Observer, A-25.

31 See, for example, http://www.realtytrac.com/content/foreclosure-market-report/2013-year-end-us-foreclosure-report-7963.

32 See, for example, http://www.irishexaminer.com/ireland/20-of-mortgages-in-arrears-as-6bn-gap-widens-245048.html.

3. We rely on the reported current mortgage insurance portfolios:

	CMHC	Genworth
• High LTV	$286 billion	$162 billion (of $264 billion)
• Low LTV	$206 billion	$18 billion (of $83 billion)
• Multi-unit	$54 billion	

CMHC portfolios are based on insurance-in-force currently outstanding, while Genworth discloses its insurance-in-force in terms of mortgage amounts at origination. According to Genworth's estimates, roughly 50 percent of these amounts are outstanding. Estimates of current insurance-in-force by Genworth in previous years have ranged from $150 billion to $200 billion. As a conservative estimate, we assume that $180 billion of the mortgage amount are still outstanding as current insurance-in-force for Genworth. Since amortization is slower on high LTV mortgages, we allocate 90 percent of the total to high LTV mortgages. Finally, note that only the CMHC insures multi-unit properties.

4. We consider the following equity shares for defaulting mortgages

- **High LTV** **10 percent**
- **Low LTV** **25 percent**
- **Multi-Unit** **30 percent**

and assume that the additional cost for the insurer on defaulted mortgages is 20 percent.

These numbers are rough estimates based on information from CMHC quarterly and annual reports. We take into account two issues. First, the probability of default is larger when equity shares are lower. Second, the default probability is likely to be higher on recently issued mortgages that tend to have higher LTVs. Hence, we have biased our estimates of the equity share downward relative to mean-equity shares officially reported. No data is readily available for equity shares in multi-unit properties, but we assume they are higher than for owner-occupied housing as lenders deem their mortgages riskier.

We adjust the value of a property in foreclosure to account for foreclosure costs. First, foreclosed properties commonly sell at a discount, which is likely to rise during a housing crisis.[33] Second, the mortgage insurer may incur additional costs when bringing a property to the market (e.g., repairs, advertising or real estate agent fees), and it is our understanding that the insurer is also responsible for covering lost interest payments until the sale. Taking these factors together, we assume a flat discount of 20 percent on the home value.

Loss estimates

We first calculate the total current loan amount of all default mortgages that trigger an insurance claim. This figure relies on insurance-in-force and the assumed default rate per class (high LTV, low LTV and multi-unit). Using our equity assumption, we then determine the value of the house before the price

33 Campbell et al. (2011) estimate the discount to be around 27 percent when compared to similar homes.

decline. In the third step, we derive the value of the house after the price decline (adjusting for foreclosure costs). This gives us the amount recovered by the insurer from the house being used as a collateral, taking into account foreclosure costs. The loss for the insurer is the difference between the house value and the outstanding loan amount (or insurance-in-force on the defaulted mortgage).

Step 1: Value of impaired mortgages

	CMHC	Genworth
High LTV	**$22.9 billion**	**$13.0 billion**
Low LTV	**$4.1 billion**	**$0.4 billion**
Multi-unit	**$5.4 billion**	n/a

Step 2: Value of homes before price decline, using equity assumptions

	CMHC	Genworth
High LTV	$22.9 billion/0.9 = **$25.4 billion**	$13.0 billion/0.9 = **$14.4 billion**
Low LTV	$4.4 billion/0.75 = **$5.5 billion**	$0.4 billion/0.75 = **$0.5 billion**
Multi-unit	$5.4 billion/0.7 = **$7.7 billion**	n/a

Step 3: Value of collateral after price decline and foreclosure costs/discount

CMHC	Genworth
High LTV $25.4 billion x 0.7 x 0.8 = **$14.2 billion**	$14.4 billion x 0.7 x 0.8 = **$8.1 billion**
Low LTV $5.5 billion x 0.7 x 0.8 = **$3.1 billion**	$0.5 billion x 0.7 x 0.8 = **$0.3 billion**
Multi-unit $7.7 billion x 0.5 x 0.8 = **$3.1 billion**	n/a

Step 4: Total losses

	CMHC	Genworth
High LTV	$8.7 billion	$4.9 billion
Low LTV	$1.0 billion	$0.1 billion
Multi unit	$2.3 billion	n/a
Total losses:	**$12.0 billion**	**$5.0 billion**

Our stress test implies losses of roughly 37 percent of the current outstanding mortgage loan values for CMHC and Genworth. This exceeds the severity ratio currently reported by Genworth (29 percent) and

CMHC (33 percent) that relates losses on claims to the original loan amount. However, this ratio is likely to increase significantly in a housing crisis when house prices fall significantly.

Changing the assumed default rates would change our loss estimates one for one. For example, cutting the cumulative default rates in half to 4 percent, 0.5 percent and 5 percent respectively would reduce the losses by 50 percent. Finally, higher equity shares for defaulted mortgages lower estimated losses. Assuming 15 percent, 35 percent and 40 percent for the three categories leads to a relatively small reduction in losses with a $9.9 billion loss for the CMHC and $4.5 billion for Genworth.

Capital Shortfalls

Under the *Protection of Residential Mortgage or Hypothecary Insurance Act*, which came into effect on January 1, 2013, the minimum capital ratio of mortgage insurers is 175 percent of the Minimum Capital Test (MCT). Hence, we define a capital shortfall as the difference between this requirement and the actual capital, after taking into account the losses estimated above. The shortfall is thus the capital required to keep a mortgage insurer operating according to regulatory standards.[34] We use the 2014 MCT values reported by CMHC in the 3rd quarter and Genworth in the 4th quarter, which are 294 percent and 225 percent, respectively.

In our calculations, we use the insurers' capital plus a fraction of unearned premiums that can be used to cover losses. Unearned premiums are the portion of premiums that are set aside to cover future losses on mortgages insured. According to our reckoning, about 6 percent of insurance-in-force is in default for the CMHC and 7.5 percent for Genworth. Consequently, high LTV mortgages and more-recently issued mortgages have a relatively higher share in unearned premiums than other mortgages. Thus, we assume that 20 percent of these premiums can be used to cover losses, while the remaining unearned premiums are allocated to performing mortgages to cover potential future losses.

Here are the actual calculations:

	CMHC	**Genworth**
Unearned Premiums (of 100 percent)	$1.1 billion ($5.7 billion)	$0.4 billion ($1.8 billion)
Current Capital	$15.9 billion	$3.3 billion
Estimated Losses	$12.0 billion	$5.0 billion
Capital after losses	$4.0 billion	$(1.3 billion)
MCT (current)	$5.3 billion	$1.5 billion
175 percent of MCT	$9.3 billion	$2.6 billion
Shortfall (175 percent of MCT)	**($5.3 billion)**	**($3.9 billion)**

34 Our data is derived from CMHC and Genworth quarterly reports.

CONCLUSION

Total estimated losses for mortgage insurers are $17 billion or roughly 1 percent of Canadian GDP.

Relative to 175 percent MCT, the CMHC would face a capital shortfall of $5.3 billion and Genworth a shortfall of $3.9 billion.

It is conceivable that the federal government would waive the 175 percent of MCT requirement for a transitional period to allow insurers to gradually rebuild their capital position. In such a scenario, the capital shortfall for the CMHC would be $1.3 billion and $2.8 billion for Genworth.

Additional Remarks

Since we abstract from losses on the insurers' investment portfolio, our estimate for the shortfall is likely biased downwards. The CMHC has additional risk exposures (see for example its NHA MBS program where it guarantees timely payment for securitized assets), which we account for by stripping out capital allocated to the CMHC's other operations and business lines.

For Genworth, a significant share of the capital shortfall would be borne by mortgage lenders due to the 10 percent deductible on the government backstop. For high LTV mortgages, the maximum of the total deductible is about $2 billion, which is 10 percent of the original insured value of the 8 percent of the defaulted mortgages with a high LTV. This lowers the relevant losses for recapitalizing Genworth to roughly $2.3 billion, with the difference being borne by the original mortgage lenders. The need to recapitalize to 175 percent of MCT is thus in the range of $1.9 to $3.9 billion and likely to be at the lower end of that number.

The total shortfall may be overestimated due to the fact that existing, but surviving mortgage loans are less likely to default after a big shock. This positive quality would lower the shortfall, as the risk-weights on an insurer's portfolio would likely be lower.

Appendix B – Calculation of Premiums for Government Backstop

How high should premiums be to finance the government backstop? Since the backstop is intended to cover the exposure from large house-price declines, we begin from the premise that the government would (at least partially) recapitalize the mortgage insurers after a housing crash.[35] According to the *Protection of Residential Mortgage or Hypothecary Insurance Act*, which came into effect on January 1, 2013, the minimum capital ratio for mortgage insurers is 175 percent of the Minimum Capital Test (MCT). However, we consider the possibility that the government could, when faced with a housing crisis, temporarily not enforce the 175-percent level, substituting a lower 100 percent requirement, providing time for insurers to gradually rebuild their capital.

Our calculations assume insurers enter a crisis with their required capital levels and face large losses as estimated in Appendix A. Based on this, we use a simple formula to determine the premiums required to provide sufficient funds for the backstop after a certain horizon. We take as given that the CMHC's exposure will be fully covered, whereas the backstop imposes a 10 percent deductible on private mortgage insurance. Consistent with our discussion in Appendix A, we assume a deductible of $1.5 billion for Genworth's counterparties. We follow current practice and express the backstop fee as a percentage on the premiums from underwriting insurance.

Our Estimate for Backstop's Long-run Exposure:

	CMHC	**Genworth**
Starting Capital	$15.9 billion	$3.3 billion
Capital after losses and reserves	$4.0 billion	($1.3 billion)
Deductible	n/a	$1.5 billion
Capital after deductible	$4.0 billion	$0.2 billion
Required Capital (175 percentMCT)	$9.3 billion	$2.6 billion
Required Capital (100 percent MCT)	$5.3 billion	$1.5 billion
Est. Exposure (175 percent MCT)	**$5.3 billion**	**$2.3 billion**
Est. Exposure (100 percent MCT)	**$1.3 billion**	**$1.3 billion**

35 A private sector recapitalization – based on a valuation of future profits – would be our preferred solution. However, we are skeptical about its feasibility during a crisis as investors are likely to be concerned about the downside risk of investing in an insolvent insurer. In practice, a private recapitalization would involve taking the bad assets out of the balance sheet of the insurers and selling off the good part of the portfolio. This would mean that government would (i) absorb the full losses and (ii) imply that the unearned premiums not associated with the bad assets would need to stay on the new balance sheet. Indeed, using all unearned premiums to cover losses is in violation of current insurance regulation as well as the principles of underwriting insurance. As with banks, the entity would be put in receivership by the government, given new capital as calculated in our stress test and temporarily run as a private, but government-owned entity. After some years, there could be a sale of equity, which could allow the government to recoup some of the recapitalization costs.

Our Simple Formula for Calculating Backstop Premiums:

$$L(1+g)^T = \sum_{t=0}^{T} a\pi(1+g)^t(1+r)^{(T-t)}$$

where

- L is exposure to be covered,
- 1+g is nominal growth in exposure and premiums,
- T is the horizon over which the backstop covers the exposure to one large shock,
- π is premiums on underwriting,
- α is the fee in percentage of premiums from underwriting insurance and
- 1+r is the investment return for the backstop.

Our formula assumes one shock occurs every T years. Over this horizon, total mortgages outstanding and premiums increase at a rate of g percent annually, and the government can invest fees at an interest rate of r percent. Define the ratio $\rho = (1+g)/(1+r)$. Rewriting the formula to take into account the fee to be charged as a percentage of underwriting, we come up with:

$$\alpha = (L/\pi)\,(1-\rho)\,\rho^T/(1-\rho^{T+1}).$$

For our calculations, only three quantities matter: the length of the horizon T, the ratio of current exposures relative to current premiums written, L/π, and (nominal) investment returns relative to growth in (nominal) exposures and premiums, ρ. With respect to the last two quantities, our results are not influenced by base amounts but only by their ratios. These ratios are assumed to be constant across time and independent of initial conditions.

Baseline Calculation

We assume annual CMHC premiums of $1.3 billion from underwriting (based on its annual report for 2013) and $640 million for Genworth, based on the exposures calculated earlier. We derive our baseline with T=30 for the horizon and ρ=1.04/1.06. The implied premiums to be paid to the backstop would have to be 9.7 percent of annual premiums written for CMHC and 8.6 percent for Genworth in order to cover recapitalization to 175 percent of MCT for the insurers. This would currently result in a charge of roughly $126 million for CMHC and $55 million for Genworth.

The results for recapitalizing up to 100 percent of MCT would be significantly lower. They are 2.4 percent and 4.9 percent for CMHC and Genworth, or $32 million and $31 million respectively. Interestingly, our analysis suggests that a relief from capital regulation benefits CMHC more than Genworth. Similarly, assuming lower growth in exposures and premiums equal to ρ=1.03/1.06 lowers the fee for the backstop to 8.2 percent and 7.3 percent of premiums when considering recapitalization to 175 percent of MCT.

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